3-21-1958

Test 643: Ford Model 651

Tractor Museum
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The Experiment Station
University of Nebraska College of Agriculture
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering
Dates of test: March 21 to 29, 1958
Manufacturer: FORD MOTOR COMPANY, BIRMINGHAM, MICHIGAN
Manufacturer's rating: Not Rated

NEBRASKA TRACTOR TEST NO. 643

FORD 651

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
		Gal per hr	Hp-hr per gal	Lb per hp-hr	Cooling medium	Air wet bulb	Air dry bulb	
TEST B—100% MAXIMUM POWER —TWO HOURS								
35.79	2200	3.273	10.93	0.555	179	55	75	29.052
TEST C—OPERATING MAXIMUM POWER—ONE HOUR								
34.24	2199	3.018	11.35	0.535	171	53	72	29.063
TEST D—RATED POWER—ONE HOUR								
31.82	2422	3.015	10.55	0.575	171	53	71	29.060
TEST E—VARYING POWER—TWO HOURS (20 minute runs; last line average)								
31.76	2418	2.997	10.60	0.572	170	52	70	.....
2.32	2508	1.335	1.74	3.491	136	51	68	.....
16.35	2478	2.127	7.69	0.789	147	52	70	.....
33.71	2207	3.007	11.21	0.541	169	53	73	.....
8.25	2501	1.672	4.93	1.229	142	53	72	.....
24.27	2455	2.582	9.40	0.645	161	52	70	.....
19.44	2428	2.287	8.50	0.713	154	52	70	29.065

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
					Gal per hr	Hp-hr per gal	Lb per hp-hr	Cooling med	Air wet bulb	Air dry bulb	
TEST H—RATED POWER—TEN HOURS—3rd Gear											
22.92	1639	5.24	2203	4.27	2.444	9.38	0.647	141	38	45	28.940
TEST F—100% MAXIMUM POWER											
29.49	2375	4.66	2002	6.58	3rd Gear.....			150	41	50	29.000
TEST G—OPERATING MAXIMUM POWER											
22.22	4114	2.03	1997	13.98	1st Gear (part throttle)			150	39	48	29.030
26.38	2885	3.43	1999	8.44	2nd Gear.....			146	39	48	29.030
27.23	2188	4.67	2001	6.20	3rd Gear.....			147	39	48	29.030
26.93	1532	6.59	2002	4.24	4th Gear.....			147	45	52	28.995
23.50	735	11.99	1998	1.79	5th Gear.....			150	45	52	28.995
TEST J—OPERATING MAXIMUM POWER											
26.20	2224	4.42	1999	13.06	3rd Gear (part throttle)			144	43	54	28.805

TEST K—SPEED-PULL CHARACTERISTIC

Pounds Pull	1639	2188	2200	2300	2450	2550	2500	2350
Horsepower	22.92	27.23	24.6	22.7	21.6	19.0	15.3	11.9
Miles Per Hour	5.24	4.67	4.2	3.7	3.3	2.8	2.3	1.9

TIRES, WHEELS AND WEIGHT

	Tests F, G, H & K	Test J
Rear wheels		
Type	Pressed Steel	Pressed Steel
Liquid ballast	396 lb each	None
Added cast iron	708 lb each	None
Rear tires		
No. and size	Two 12.4-28	Two 12.4-28
Ply	4	4
Air pressure	14 lb	12 lb
Front wheels		
Type	Pressed Steel	Pressed Steel
Liquid ballast	None	None
Added cast iron	None	None
Front tires		
No. and size	Two 5.50-16	Two 5.50-16
Ply	4	4
Air pressure	28 lb	28 lb
Height of drawbar	17½ inches	19 inches
Static weight		
Rear end	4130 lb	1922 lb
Front end	1224 lb	1224 lb
Total weight as tested with operator	5529 lb	3321 lb

FUEL, OIL, WATER and TIME Fuel Gasoline **Octane No.** ASTM 83.6 **Research** 90.4 (rating taken from oil company's typical inspection data) **Weight per gallon** 6.066 lb **Oil** SAE 10W **To motor** 1.224 gal **Drained from motor** 0.513 gal **Water used** 0.123 gal **Total time motor was operated** 44½ hours.

CHASSIS Type Standard **Serial No.** 651-8813 **Tread width rear** 52" to 76" **front** 52" to 80" **Wheel base** 74.5" **Hydraulic control system** direct engine drive **Advertised speeds mph** first 2.39 second 3.79 third 5.04 fourth 6.96 fifth 12.38 reverse 4.07 **Belt pulley diam.** 9" **face** 6.50" **rpm** 1279 **Belt speed** 3013 fpm **Belt** flat **Length** 71' **Width** 6" **Thickness** 0.215" **Maximum slip** 0.80% **Clutch** single plate dry disc operated by foot pedal **Seat** pressed steel cushioned by rubber in torsion **Brakes** internal expanding shoes operated by two foot pedals on right side of tractor **Equalized** by foot action **Power take-off** conventional type **Steering** aided by hydraulic power steering.

ENGINE Make Ford **Type** 4-cylinder vertical **Serial No.** 651-8813 **Crankshaft mounted** lengthwise **Head** I **Lubrication** pressure **Bore and stroke** 3.44" x 3.60" **Rated rpm** belt 2200 drawbar 2000 **Compression ratio** 7.50 to 1 **Displacement** 134 cu. in. **Valves port diameter Inlet** 1.46" **Exhaust** 1.26" **Governor** variable speed centrifugal **Carburetor size** 1" **Ignition system** battery **Starting system** 6-volt battery **Air cleaner** oil washed wire mesh **Muffler** was used **Oil filter** full flow with replaceable paper element **Cooling medium temperature control** thermostat.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, J, and K were made with an operating setting of the carburetor (selected by the manufacturer) of 95.3% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60°F and 29.92" Hg)	30.13	37.39
2. Observed maximum horsepower (tests F and B)	29.49	35.79
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE Ratings)	22.60	31.78

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 643.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT, Chairman
G. W. STEINBRUEGGE
J. J. SULEK
Board of Tractor
Test Engineers

EXPLANATION OF TEST REPORT

TEST A: The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissable include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

BELT HORSEPOWER TESTS

TEST B: The manual throttle control lever is set so that the throttle valve is held wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

TEST C: For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors which have an altogether different fuel system.

TEST D: The manual throttle control lever is set the same as for tests B and C allowing the governor to control engine speed at part throttle. Load is applied until 85% of maximum corrected horsepower found in test B is obtained.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

TEST E: Varying load serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each; rated load, no load, ½ rated load, maximum load at wide open throttle valve, ¼ and ¾ rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. When rubber tires are used, all tests are made on the concrete test course. The same tires, wheels and weights are used for all tests except J. All crawler type tractors are tested on an earthen test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same for each test.

TEST F: A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in the test. The drawbar load is adjusted to give rated engine speed.

TEST G: Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The manual throttle control lever is set so that the throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 15%. When the load is reduced it is necessary to operate the tratcor engine at part throttle and control engine speed by governor action.

TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated horsepower the manual throttle control lever is set the same as in tests F and G allowing the governor to maintain engine speed at part throttle. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

TEST J: The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

TEST K: This is intended to show the pull, horsepower, and travel speed of the tractor at rated horsepower (taken from test H); maximum horsepower (taken from test G); and at least four other conditions obtained by reducing travel speed in 10% increments by overload.